ANSWERS: Calorimetry calculations

In your exam you will be provided with the SHC (Specific Heat Capacity) if needed: specific heat capacity of water = 4.18 J g^{-1} $°C^{-1}$

1) 72.0 g / 18.0 g mol^{-1} = 4.00 mol of water being boiled.

Energy required to do this 4.00 mol × 40.7 kJ mol^{-1} = 162.8 kJ

This is the amount of energy that the combustion of methane in the Bunsen is required to produce.

162.8 kJ / 889 kJ mol^{-1} = 0.183 mol of methane to be combusted.

Mass of methane = 0.183 mol × 16.0 g mol^{-1} = 2.93 g.

2) i) n = 0.400 g / 86.0 g mol^{-1} = 0.00465 mol

Energy absorbed = $q = mc\Delta T$ = 150 g × 4.18 J g^{-1} $°C^{-1}$ × 17°C

= 10659 J / 10.695kJ / 10.7kJ

ΔH = –10 659 J / 0.00465 mol **= –2292 or -2290 or –2300 kJ mol^{-1}**

ii)

- Heat lost to the surroundings needs better insulation such as: lid on the beaker /lagging on the beaker /containment of the heat from the flame.
- Incomplete combustion occurs, ensure plenty of oxygen is supplied
- Not done under standard conditions make sure done at 25º and 1 atmosphere pressure (must stipulate STP).

3) 50.0 g × 2.70°C × 4.18 J g^{-1} $°C^{-1}$ = 564.3 J

$n(NH_4NO_3)$ = 1.80 g ÷ 80 g mol^{-1} = 2.25 × 10^{-2} mol

Energy absorbed when 1 mol dissolves = 564.3 J ÷ 2.25 × 10^{-2} mol = 25 080 J

$\Delta_r H$ = + 25.1 kJ mol^{-1}

4) E = 200 × 4.18 × 18 = 15 048 joules = 15.048 kJ released

n(ethanol) = 1.00 g / 46 g mol–1 = 0.0217 mol

$\Delta c H$ = –15.048 kJ/ 0.0217 mol = – 693 kJ mol-1